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PROVISIONAL APPLICATION COVER SHEET

PF0000055198/psa

This is a request for filing a PROVISIONAL APPLICATION under 35 USC 111(b).

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2. TITLE OF THE INVENTION: HERBICIDAL COMPOSITION FOR CONTROLLING CONIFEROUS PLANTS

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4. ENCLOSED APPLICATION PARTS:

[X] Specification 15 pages  
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5. METHOD OF PAYMENT

[X] A check in the amount of \$160.00 is attached to cover the required Provisional filing fee.

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6. The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[X] No

Respectfully submitted,  
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## Herbicidal composition for controlling coniferous plants

### Description

- 5 The present invention relates to new herbicidal compositions which are useful for controlling coniferous plants, in particular naturally seeded conifer plants (wildling conifer) and especially for controlling wildling pine, i. e. naturally seeded pine plants.

- 10 The control of naturally seeded coniferous plants (wildling conifer control) has become an important issue in forestry. In conifer plantations and especially in pine plantations naturally seeded coniferous plants (wildlings) compete with planted ones. However, these wildlings are genetically inferior and result in sub-optimal stand density.

- 15 It is expected that the problem of wildling conifers will increase in the future for the following reasons: the use of fire to control wildling conifers in site preparation has been severely restricted by the government, the use of mechanical site preparation has diminished; the adoption of intensive management including vegetation control, fertilization and thinning is increasing the number of wild germinants and seedlings in existing stands and after harvest; with small harvesting areas becoming increasingly  
20 common, overseedings from neighbouring stands and overstocking of young plantations become more prevalent. Therefore, forest managers need a treatment that controls these unwanted wildling seedlings and releases genetically improved, newly planted conifer seedlings with no or marginal damage.

- 25 The major compounds currently used for wildling conifer control in conifer plantations include glyphosate and fosamine. Both compounds require high application rates. Moreover, lack of consistency in control is an issue with glyphosate.

- 30 F.L. Yeiser reported in "Proceedings of Southern Weed Science Society", vol. 53, pp 153 ff. about the use of commercial bromacil/diuron mixtures and of azafenidine in wildling pine control. However, the achieved control was only similar to control achieved by sulfometuron-methyl which is used in forestry for conventional weed control. Same author reported in "Proceedings of Southern Weed Science Society" vol. 54 (2001), section IV, p. 94 to 98 about investigations on wildling pine control by  
35 combined pre- and post-emergence treatments with sulfometurone, fosamine, azafenidine and azafenidine/sulfometurone-methyl mixtures. However, control of pine germination by these methods was inadequate.



## 2

Therefore, it is an objective of the present invention to provide compounds that allow a reliable and effective wildling conifer control. Moreover, these compounds should release newly planted conifer seedlings without or with only slight damaging.

5 Surprisingly, it was found that this object could be achieved by a herbicidally active composition which comprises:

- a) at least one herbicide A selected from imidazolinone herbicides and
  - b) at least one further herbicide B selected from the group consisting of sulfentrazone, carfentrazone, their agriculturally acceptable salts and their
- 10 agriculturally acceptable derivatives.

These compositions allow an effective control of wildling conifers, in particular of wildlings which belong to the pinaceae family and especially the control of wildling pine species (generally referred to as wildling pine control). Moreover, the compositions of

15 the present invention lead to a reduction of undesired weeds and thus facilitate the growth of the planted coniferous plants.

Therefore, the present invention provides a herbicidal composition as defined above and a method for controlling coniferous plants, in particular naturally seeded coniferous

20 plants (wildling conifers), wherein an effective amount of

- a) at least one herbicide A, which is selected from imidazolinone herbicides, and
  - b) at least one further herbicide B, which is selected from the group consisting of
- 25 sulfentrazone, carfentrazone, their agriculturally acceptable salts and their agriculturally acceptable derivatives

is applied to the coniferous plants to be controlled or to their parts, such as roots, leaves, seeds or germinants.

30

Suitable imidazolinone herbicides comprise imazethabenz, imazamox, imazapic, imazapyr, imazaquin and imazethapyr, with particular preference being given to imazapyr.

35 Preferred herbicide B is carfentrazone.

Since the aforementioned imadizolinone herbicides A and carfentrazone have an acidic carboxyl group, they may also be applied as their agriculturally acceptable salts or as their agriculturally acceptable derivatives.

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## 3

The agriculturally acceptable salts of the herbicides A as well as of carfentrazone comprise at least one agriculturally acceptable counter ion. Suitable counterions are alkalimetal ions, e. g. lithium, sodium or potassium ions, alkaline earth metal ions, e. g. calcium or magnesium ions, ammonium ( $\text{NH}_4^+$ ) and substituted ammonium in which one to four of the hydrogen atoms are replaced by  $\text{C}_1$ - $\text{C}_4$ -alkyl,  $\text{C}_1$ - $\text{C}_4$ -hydroxyalkyl,  $\text{C}_1$ - $\text{C}_4$ -alkoxy,  $\text{C}_1$ - $\text{C}_4$ -alkoxy- $\text{C}_1$ - $\text{C}_4$ -alkyl, hydroxy- $\text{C}_1$ - $\text{C}_4$ -alkoxy- $\text{C}_1$ - $\text{C}_4$ -alkyl,  $\text{C}_3$ - $\text{C}_8$ -cycloalkyl, phenyl or benzyl. Examples of substituted ammonium ions comprise methylammonium, isopropylammonium, dimethylammonium, diisopropylammonium, trimethylammonium, tetramethylammonium, tetraethylammonium, tetrabutylammonium, dicyclohexylammonium, tris(2-hydroxyethyl)ammonium, 2-hydroxyethylammonium, 2-(2-hydroxyethoxy)ethylammonium, bis(2-hydroxyethyl)ammonium, benzyltrimethylammonium and benzyltriethylammonium.

It is also possible to use the herbicides A as their agriculturally acceptable derivatives, e. g. as amides such as primary amides, mono- or di- $\text{C}_1$ - $\text{C}_6$ -alkylamides, anilides or preferably as esters, e. g. as allylesters, propagylesters,  $\text{C}_1$ - $\text{C}_8$ -alkylesters,  $\text{C}_1$ - $\text{C}_4$ -alkoxy- $\text{C}_1$ - $\text{C}_4$ -alkylesters and also as thioesters. Preferred derivatives of herbicides A and of carfentrazone, respectively, are the aforementioned esters, in particular the alkyl esters and the alkoxyalkyl esters and especially the methyl, ethyl, isopropyl, isobutyl, 2-butoxyethyl, 2-butoxy-1-methylethyl, 1-methylheptyl, isooctyl, 1-methylhexyl or 2-ethoxyethyl esters such as carfentrazone ethyl.

In the method of the invention herbicide A and herbicide B can be applied jointly or separately, i. e. simultaneously or successively. In order to achieve effective control of the naturally seeded coniferous plants, it is only required that the herbicide A and the herbicide B affect the coniferous plants to be controlled or their parts at the same time. The term "coniferous plants to be controlled or their parts" is understood to comprise naturally seeded conifer seedlings, their roots, cones and leaves as well as their seeds and their germinants. Consequently, the herbicidal composition of the invention can be formulated in one formulation that comprises both herbicides A and B as well as in two separate formulations as a two-kits-of-parts, i.e. one formulation comprises herbicide A and the other comprises herbicide B. These two separate formulations can be mixed before applying them and thus herbicides A and B are applied jointly. However these two formulations may also be applied separately, provided that herbicide A and herbicide B act at the same time on the plants to be controlled or on their parts. It is, however, preferable to apply herbicides A and B jointly.

The amount of herbicide B which is necessary to achieve an effective control will in general vary from 10 g/ha to 500 g/ha, preferably from 50 g/ha to 450 g/ha and ideally from 200 g/ha to 450 g/ha. Here and in the following the amounts given for herbicides

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A and B refer to the active portion of the herbicide molecule. Thus in the case of salts or derivatives the amounts refer to the free acid.

5 In the process of the present invention the herbicide A is usually applied in amounts from 100 g/ha to 1400 g/ha, preferably from 400 g/ha to 1400 g/ha and ideally from 500g/ha to 900 g/ha.

10 In general, the herbicide A and the herbicide B will be applied in a weight ratio A : B ranging from 200 : 1 to 1 : 5, preferably from 100 : 1 to 1 : 2 and ideally from 30 : 1 to 1 : 1. The compositions of the invention preferably contain herbicide A and herbicide B in weight ratio A:B ranging from 200 : 1 to 1 : 5, preferably from 100 : 1 to 1 : 2 and ideally from 30 : 1 to 1 : 1.

15 Herbicides A and B may be applied by any means which are customary in the field of crop-protection and especially in the field of forestry. Herbicides A and B may be applied, for example, in the form of directly sprayable aqueous emulsions, suspensions as directly sprayable powders and dusts, and also as highly-concentrated aqueous, oily or other suspensions or dispersions, as oil dispersions or as granules. Depending on the kind of formulation they will be applied by means of spraying, atomizing, dusting, 20 broadcasting or watering. The person skilled in the art is sufficiently familiar with useful formulations and means of applying them. In any case, those formulation and the means of applying them should ensure the finest possible distribution of the active compounds A and B.

25 In order to achieve wildling conifer control, herbicides A and B are preferably applied to the naturally seeded coniferous seedlings as a whole or to their roots or leaves. However herbicides A and B can be also applied to the germinants of the conifers to be controlled. In a preferred embodiment of the invention, control is achieved by applying herbicides A and B after germination of the wildling seed, i.e. by post-emergence 30 treatment of the wild conifer seedlings.

Herbicides A and B are applied to the area to be protected from wildling conifer mainly by spraying. Application can be carried out by customary spraying techniques using, for example, water as carrier and spray liquor rates ranging from about 50 to 1 000 l/ha 35 (for example from 100 to 300 l/ha). Application of herbicides A and B by the low-volume and the ultra-low-volume method is possible, as is their application in the form of microgranules.

40 Application of herbicides A and B can be done by over-the-top treatment of the wildlings or by directed treatment of the wildlings, e. g. by directed or spot-spraying.

## 5

Preferably, the herbicides A and B are applied during site-preparation, i.e. before the conifer seedlings are planted. However it is also possible to apply herbicides A and B in conifer plantations, i. e. in the presence of planted conifer seedlings or trees. In this case, herbicides A and B are preferably applied by directed treatment of the wildings in order to leave the planted seedlings or trees unaffected.

Preferably herbicides A and B are applied in the site-preparation of pine plantations, and especially the site-preparation for plantations of pine species selected from *P. banksiana*, *P. clausa*, *P. contorta*, *P. echinata*, *P. elliotii*, *P. lambertina*, *P. palustris*, *P. glabra*, *P. ponderosa*, *P. pungens*, *P. rigida*, *P. resinosa*, *P. serotina*, *P. strobus*, *P. taeda*, *P. virginiana*.

In particular, the method of the invention comprises at least one application of herbicides A and B within 1 year and ideally within 10 month prior to planting of the conifer seedlings. More preferably herbicides A and B are applied within the period from 3 to 10 month and especially from 6 to 10 month prior to planting of the conifer seedlings. However, it is also possible to apply herbicides A and B shortly before or up to the day when the conifer seedlings are planted. Preferably herbicides A and B are applied in spring or in summer, more preferably from the beginning of March until the end of August in the northern hemisphere or from beginning of September until the end of february in the southern hemisphere. The application of herbicides A and B can be repeated once, twice or more often until the conifer seedlings are planted. The periods between each application may vary from 0,5 month to 6 month. However, generally one application is sufficient. In case of several applications it is preferable that the total application rate of all applications does not exceed the above given maximum application rates.

Depending on the form in which the ready-to-use preparations are present in the compositions according to the invention, they comprise one or more liquid or solid carriers, if appropriate, surfactants and, if appropriate, further auxiliaries which are customary for formulating crop protection products. The person skilled in the art is sufficiently familiar with the recipes for such formulations.

Suitable inert auxiliaries with carrier function are e.g.:

- liquid carriers such as mineral oil fractions with a medium to high boiling point, such as kerosine and diesel oil, furthermore coal tar oils and oils of vegetable or animal origin, aliphatic, cyclic and aromatic hydrocarbons, e.g. paraffins, tetrahydronaphthalene, alkylated naphthalenes and their derivatives, alkylated benzenes and their derivatives, alcohols such as methanol, ethanol, propanol,



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- butanol and cyclohexanol, ketones such as cyclohexanone, strongly polar solvents, e.g. amines such as N-methylpyrrolidone, and water, and
- 5 solid carriers such as mineral earths e.g. silicas, silica gels, silicates, talc, kaolin, limestone, lime, chalk, bole, loess, clay, dolomite, diatomaceous earth, calcium sulfate, magnesium sulfate, magnesium oxide, ground synthetic materials, fertilizers such as ammonium sulfate, ammonium phosphate, ammonium nitrate, ureas, and products of vegetable origin such as cereal meal, tree bark meal, wood meal and nutshell meal, cellulose powders, or other solid carriers.
- 10 Suitable auxiliaries comprise any auxiliaries which are usually employed in formulations of herbicides, e.g. tackifiers, anti-oxidants, preservatives, rheology modifiers such as thickeners, anti-freezes, defoamers and surface active substances.
- 15 The latter comprise emulsifiers, protective colloids, wetting agents, anti-settling agents and dispersants that are normally employed in agricultural formulations of herbicides. The surface-active substances may be nonionic, anionic and/or cationic. Suitable surfactants which may be used in the compositions of the invention are disclosed e. g. in "McCutcheon's Detergents and Emulsifiers Annual", MC Publishing Corp.,
- 20 Ridgewood, NJ, USA 1981; H. Stache, "Tensid-Taschenbuch", 2<sup>nd</sup> ed., C. Hanser, Munich, Vienna, 1981; M. and J. Ash, "Encyclopedia of Surfactants", vol. I-III, Chemical Publishing Co., New York, NY, USA 1980-1981. Suitable surfactants are e.g. the alkali metal salts, alkaline earth metal salts and ammonium salts of aromatic sulfonic acids, e.g. ligno-, phenol-, naphthalene- and dibutyl-naphthalenesulfonic acid, and of fatty
- 25 acids, of alkyl- and alkylarylsulfonates, of alkyl sulfates, lauryl ether sulfates and fatty alcohol sulfates, and salts of sulfated hexa-, hepta- and octadecanols and of fatty alcohol glycol ethers, condensates of sulfonated naphthalene and its derivatives with formaldehyde, condensates of naphthalene or of the naphthalenesulfonic acids with phenol and formaldehyde, polyoxyethylene octylphenol ether, ethoxylated isooctyl-,
- 30 octyl- or nonylphenol, alkylphenyl polyglycol ether, tributylphenyl polyglycol ether, alkylaryl polyether alcohols, isotridecyl alcohol, fatty alcohol/ethylene oxide condensates, ethoxylated castor oil, polyoxyethylene alkyl ether or polyoxypropylene alkyl ether, lauryl alcohol polyglycol ether acetate, sorbitol esters, lignosulfite waste liquors or methylcellulose.
- 35 Suitable thickening agents include inorganic thickening agents, such as clays, hydrated magnesium silicates and organic thickening agents, such as polysaccharide gums, like xanthan gum, guar gum, gum arabic and cellulose derivatives. Suitable preservatives to prevent microbial spoiling of the compositions of the invention include formaldehyde,
- 40 alkyl esters of p-hydroxybenzoic acid, sodium benzoate, 2-bromo-2-nitropropane-1,3-diol, o-phenylphenol, thiazolinones, such as benzisothiazolinone, 5-chloro-2-methyl-4-



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isothiazolinone, pentachlorophenol, 2,4-dichlorobenzyl alcohol and mixtures thereof. Suitable anti-freezing agents include organic solvents which are completely miscible with water, such as ethylene glycol, propylene glycol, other glycols, glycerin or urea. Suitable defoamers include polysiloxanes, such as polydimethyl siloxane.

5

Aqueous use forms of herbicides A and B can be prepared from emulsion concentrates, suspensions, pastes, wettable powders or water-dispersible granules by adding water. To prepare emulsions, pastes or oil dispersions, herbicides A and B as such or dissolved in an oil or solvent, can be homogenized in water by means of a wetting agent, tackifier, dispersant or emulsifier. Alternatively, it is also possible to prepare concentrates comprising the active substance, wetting agent, tackifier, dispersant or emulsifier and, if desired, solvent or oil, and these concentrates are suitable for dilution with water.

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15 Powders, materials for spreading and dusts can be prepared by mixing or concomitantly grinding the active substances with a solid carrier.

Granules, e.g. coated granules, impregnated granules and homogeneous granules, can be prepared by binding the active compounds to solid carriers.

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The concentrations of the active compounds in the ready-to-use preparations can be varied within wide ranges. In general, the compositions of the invention comprise approximately from 0.001 to 98% by weight, preferably 0.01 to 95% by weight, of active compounds. The active compounds are employed in a purity ranging from 90% to 100%, preferably 95% to 100% (according to NMR spectrum).

25

The compositions according to the invention can, for example, be formulated as follows:

30 I 20 parts by weight of the active compound or active compound mixture in question are dissolved in a mixture composed of 80 parts by weight of alkylated benzene, 10 parts by weight of the adduct of 8 to 10 mol of ethylene oxide to 1 mol of oleic acid N-monoethanolamide, 5 parts by weight of calcium dodecylbenzenesulfonate and 5 parts by weight of the adduct of 40 mol of ethylene oxide to 1 mol of castor oil. Pouring the solution into 100 000 parts by weight of water and finely distributing it therein gives an aqueous dispersion which comprises 0.02% by weight of the active compound.

35

II 20 parts by weight of the active compound or active compound mixture in question are dissolved in a mixture composed of 40 parts by weight of cyclohexanone, 30 parts by weight of isobutanol, 20 parts by weight of the adduct of 7 mol of e-

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## 8

ethylene oxide to 1 mol of isooctylphenol and 10 parts by weight of the adduct of 40 mol of ethylene oxide to 1 mol of castor oil. Pouring the solution into 100 000 parts by weight of water and finely distributing it therein gives an aqueous dispersion which comprises 0.02% by weight of the active compound.

5

III 20 parts by weight of the active compound or active compound mixture in question are dissolved in a mixture composed of 25 parts by weight of cyclohexanone, 65 parts by weight of a mineral oil fraction with a boiling point of 210 to 280°C and 10 parts by weight of the adduct of 40 mol of ethylene oxide to 1 mol of castor oil. Pouring the solution into 100 000 parts by weight of water and finely distributing it therein gives an aqueous dispersion which comprises 0.02% by weight of the active compound.

10

IV 20 parts by weight of the active compound or active compound mixture in question are mixed thoroughly with 3 parts by weight of sodium diisobutyl-naphthalene-sulfonate, 17 parts by weight of the sodium salt of a lignosulfonic acid from a sulfite waste liquor and 60 parts by weight of pulverulent silica gel, and the mixture is ground in a hammer mill. Finely distributing the mixture in 20 000 parts by weight of water gives a spray mixture which comprises 0.1% by weight of the active compound.

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V 3 parts by weight of the active compound or active compound mixture in question are mixed with 97 parts by weight of finely divided kaolin. This gives a dust which comprises 3% by weight of the active compound.

25

VI 20 parts by weight of the active compound or active compound mixture in question are mixed intimately with 2 parts by weight of calcium dodecylbenzenesulfonate, 8 parts by weight of fatty alcohol polyglycol ether, 2 parts by weight of the sodium salt of a phenol-urea-formaldehyde condensate and 68 parts by weight of a paraffinic mineral oil. This gives a stable oily dispersion.

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VII 1 part by weight of the active compound or active compound mixture in question is dissolved in a mixture composed of 70 parts by weight of cyclohexanone, 20 parts by weight of ethoxylated isooctylphenol and 10 parts by weight of ethoxylated castor oil. This gives a stable emulsion concentrate.

35

VIII 1 part by weight of the active compound or active compound mixture in question is dissolved in a mixture composed of 80 parts by weight of cyclohexanone and 20 parts by weight of Wettol® EM 31 (nonionic emulsifier based on ethoxylated castor oil). This gives a stable emulsion concentrate.

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The compositions as well as the method according to the present invention are suitable for controlling naturally seeded coniferous plants, in particular wildling plants belonging to the family of pinaceae. They are especially useful for controlling wildling conifer plants belonging to the genus of pinus, in particular those of the subgenera P.

- 5 contortae, P. australes, P. sylvestres and P. strobi, e.g. wildlings of the species P. banksiana, P. clausa, P. contorta, P. echinata, P. elliotii, P. lambertina, P. ponderosa, P. glabra, P. palustris, P. pungens, P. rigida, P. resinosa, P. serotina, P. strobus, P. taeda or P. virginiana. The method of the invention is particularly useful for controlling the pine species P. banksiana, P. echinata, P. elliotii, P. lambertina, P. palustris, P.  
10 rigida, P. ponderosa, P. contorta, P. strobus, P. taeda and P. virginia.

- The compositions as well as the method according to the present invention are also useful for controlling other undesirable vegetation in forestry, in particular herbaceous weeds such as *Amaranthus* spp., *Ipomoea lacunosa*, *Ipomoea hederacea*, *Ambrosia*  
15 *artemisiifolia*, *Solanum ptycanthum*, *Campsis radicans* etc. Thereby, planting of conifer seedlings as well as its growth are facilitated.

- Moreover, it may be useful to apply the compositions according to the invention jointly as a mixture with other crop protection products, for example with pesticides or agents  
20 for controlling phytopathogenic fungi or bacteria. Also of interest is the miscibility with mineral salt solutions which are employed for treating nutritional and trace element deficiencies. Non-phytotoxic oils and oil concentrates may also be added.

- The invention is further illustrated by the following examples.  
25

The effect of the herbicidal mixtures according to the invention on the growth of wildling conifer, in particular wildling pine (*Pinus* spp.) was demonstrated by the following greenhouse and field experiments:

- 30 Greenhouse Experiments:

- For the following experiments herbicides A and B were applied as an aqueous spray liquor, which was prepared from their commercially available formulations. Herbicide A (imazapyr as its isopropylammonium salt) was used as an emulsifiable concentrate  
35 (240 grams acid eq/l; CHOPPER® from BASF Corporation). Component B (carfentrazone) was used as a wettable granule (40% by weight; AIM®, from FMS). Methylated seed oil (MSO) was also added to the spray liquor in amounts of 5% volume/volume as a standard spray adjuvant. Water was used as the carrier.

- 40 The spray liquor had the following general recipe:



## 10

Herbicide A (imazapyr) 12.5 ml/L 0.56 kg active/ha  
Herbicide B (carfentrazone) 6.0 g/L 0.45 kg active/ha  
methylated seed oil 50.0 ml/L 5.0 % v/v

- 5 Wildling pine of the variety Loblolly (*Pinus taeda* L.) were first grown to a height of 50 to 60 cm (one yr old seedlings) and then postemergence herbicide applications were made. Here, the herbicidal compositions were suspended or emulsified in water as distribution medium to obtain a spray liquor, which was sprayed on the wildlings by using finely distributing nozzles, e.g. even flat fan spray nozzles. Spray liquor rate was 183 l/ha. The experiment was set up as a completely random design with four replications (one seedling per replication).

15 The test period extended over 30 days at 27°C. During this time, the plants were tended, and their response to the treatments with the active compound was evaluated.

The evaluation for the damage caused by the chemical compositions was carried out using a scale from 0 to 100%, compared to the untreated control plants. Here, 0 means no damage and 100 means complete destruction of the plants. The results are presented in table 1.

20

Table 1:

Treatment	Rate	Loblolly Pine
	kg active/ha*	% control**
Control	---	0
Imazapyr	0.56	0
Imazapyr + Carfentrazone	0.56 + 0.45	84

\* means of four replications

- 25 The data in Table 1 show that carfentrazone + imazapyr provided increased control of the loblolly pine seedlings at day 30 after treatment.

## Field Experiments

- 30 For the following experiments herbicides A and B were applied as an aqueous spray liquor, which was prepared from their commercially available formulations. Herbicide A (imazapyr as its isopropylammonium salt) was used as an emulsifiable concentrate (240 grams acid eq/l; CHOPPER® from BASF Corporation). Component B (carfentrazone) was used as a wettable granule (40% by weight; AIM®, from FMC). Methylated seed oil (MSO) was also added to the spray liquor in amounts of 12,5% volume/volume as a standard spray adjuvant. Water was used as the carrier.

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The spray liquor had the following general recipe:

5	Herbicide A (imazapyr)	12.5 ml/L	0.56 kg active/ha
	Herbicide B (carfentrazone)	0.75 - 6.0 g/L	0.056 - 0.45 kg active/ha
	methyated seed oil	125.0 ml/L	12.5 % v/v

#### Site One

- 10 The test site selected consisted of a population of wildling pine of the variety Slash (*Pinus elliottii*) that were allowed to grow to a height of 90 to 150 cm (2 yr old seedlings) and then treated. Here, the herbicidal compositions were suspended or emulsified in water as the distribution medium and sprayed using finely distributing nozzles, e.g. flat fan spray nozzles. Spray liquor rate was 183 l/ha. Experiment design
- 15 used was a randomized complete block design with three replications (5 seedling per replication).

The test period extended over 163 days. During this time, response to the treatments with the active compound was evaluated.

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The evaluation for the damage caused by the chemical compositions was carried out using a scale from 0 to 100%, compared to the untreated control plants. Here, 0 means no damage and 100 means complete destruction of the plants. The results are presented in table 2.

25

Table 2:

Treatment	Rate	Slash Pine
	kg active/ha	% control*
Control	---	0
Imazapyr + Carfentrazone	0.56 + 0.056	50
Imazapyr + Carfentrazone	0.56 + 0.220	93
Imazapyr + Carfentrazone	0.56 + 0.450	90

\* means of three replications, ratings at 163 days after treatment

- Results presented in Table 2 confirmed greenhouse results of the susceptibility of
- 30 wildling pine to applications of imazapyr + carfentrazone.

#### Site Two

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## 12

The test site selected consisted of a natural population of wildling pine of the variety Loblolly (*Pinus taeda*). Pines were 60 to 150 cm in height at treatment. Application set up was similar to that described for site one. The results are presented in table 3.

5 Table 3.

Treatment	Rate	Loblolly Pine
	kg active/ha	% control*
Control	---	0
Imazapyr	0.56	10
Imazapyr + Carfentrazone	0.56 + 0.220	80
Imazapyr + Glyphosate	0.56 + 4.5	60

\* means of three replications, ratings at 82 days after treatment

Results presented in Table 3. also confirmed the susceptibility of wildling pine to applications of carfentrazone. At the 82-day rating, control with carfentrazone was superior to that of a standard glyphosate mixture.

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BASF Aktiengesellschaft

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We claim:

1. A herbicidal composition which comprises:
  - 5 a) at least one herbicide A selected from imidazolinone herbicides, and
  - b) at least one further herbicide B selected from the group consisting of sulfentrazone, carfentrazone, their agriculturally acceptable salts and their agriculturally acceptable derivatives.
- 10 2. The herbicidal composition as claimed in claim 1, wherein the herbicide A is selected from imazapyr, its agriculturally acceptable salts and its agriculturally acceptable derivatives.
- 15 3. The herbicidal composition as claimed in claim 1, wherein the weight ratio of herbicide A to herbicide B ranges from 1:5 to 200:1.
4. A method for controlling coniferous plants, wherein an effective amount of
  - 20 a) at least one herbicide A selected from imidazolinone herbicides, and
  - b) at least one further herbicide B selected from the group consisting of sulfentrazone, carfentrazone, their agriculturally acceptable salts and their agriculturally acceptable derivatives
- 25 is applied to coniferous plants to be controlled and/or to the parts of these plants.
5. The method as claimed in claim 4, wherein the effective amount of herbicide A and herbicide B is applied during site preparation for a plantation of coniferous
  - 30 trees.
6. The method as claimed in claim 4, wherein the herbicide A and the herbicide B are applied in a weight ratio A:B ranging from 1:5 to 200:1.
- 35 7. The method as claimed in claim 4, wherein the herbicide A is applied in amounts from 100 to 1400 g/ha.
8. The method as claimed in claim 4, wherein the herbicide B is applied in amounts from 10 to 500 g/ha.

9. The method as claimed in claim 4, wherein the effective amount of herbicide A and herbicide B is applied after emergence of the coniferous plants to be controlled.

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10. The method as claimed in claim 4, wherein the coniferous plants to be controlled belong to the pinaceae family.

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11. The method as claimed in claim 11, wherein the coniferous plants to be controlled are selected from the pine species *P. banksiana*, *P. clausa*, *P. echinata*, *P. ellioti*, *P. contorta*, *P. palustris*, *P. glabra*, *P. lambertina*, *P. ponderosa*, *P. pungens*, *P. rigida*, *P. resinosa*, *P. serotina*, *P. strobus*, *P. taeda* and *P. virginiana*.

# Herbicide composition for controlling coniferous plants

## Abstract

- 5 The present invention relates to new herbicide compositions which comprises:
- a) at least one herbicide A selected from imidazolinone herbicides and
  - b) at least one further herbicide B selected from the group consisting of sulfentrazone, carfentrazone, their agriculturally acceptable salts and their agriculturally acceptable derivatives.

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These compositions are useful for controlling coniferous plants, in particular naturally seeded conifer plants and especially for controlling wildling pine, i. e. naturally seeded pine plants.